1200V 30mohm Silicon Carbide Power MOSFET
AK1CK2M030WAMH

Features:

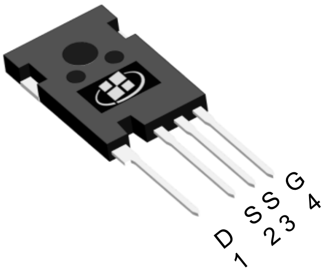
- Low on-resistance
- Fast switching speed with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen-free, RoHS compliant

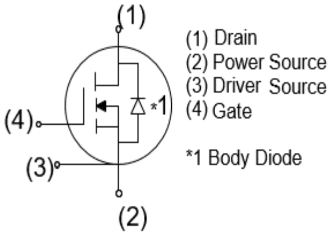
Applications:

- Motor drives
- Switched mode power supplies

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	1200	V
$R_{DSON,\ TYP}$ @V_{GS} = 18 V	26	mΩ
I_D	73.5	A
P_D	340	W





Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK1CK2M030WAMH	TO-247-4L	1CK2M030WAMH	Tube	See the detail package information

Rev.1.0 2024

Maximum Ratings (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Value	Units
V_{DS}	Drain-Source Voltage	1200	V
I_D	Drain Current - Continuous (T_C = 25°C) (Note 1)	73.5	A
	Drain Current - Continuous (T_C = 100°C) (Note 1)	52	A
I_{DM}	Drain Current - Pulsed (Note 2)	183	A
V_{GS}	Gate - Source Voltage (dynamic)	-10/+22	V
V_{GS}	Gate - Source Voltage (static)	-6/+18	V
P_D	Power Dissipation (T_C = 25°C)	340	W
$T_{J,}$ T_{STG}	Operating and Storage Temperature Range	-55 to +175	°C

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction - to - Case, Steady - State	0.44	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady - State	40	°C/W

Notes:

1. The max drain current limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature

Electrical Characteristics (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static Characteristics						
$V_{(BR)DSS}$	Drain - Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 μA	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200 V, V_{GS} = 0 V		5	50	μA
I_{GSS}	Gate Leakage Current	V_{GS} = + 22 V, V_{DS} = 0 V			100	nA
		V_{GS} = - 10 V, V_{DS} = 0 V			-100	nA
$V_{GS(th)}$	Gate Threshold voltage	V_{DS} = V_{GS}, I_D = 11.5 mA	2.2	2.6	4.2	V
		V_{DS} = V_{GS}, I_D = 11.5 mA, T_J = 175 °C		1.9		V
$R_{DS(ON)}$	Drain-Source on-state resistance	V_{GS} = 18 V, I_D = 40 A		26	35	mΩ
		V_{GS} = 18 V, I_D = 40 A, T_J = 175 °C		47		mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 40 A		23		S
		V_{DS} = 20 V, I_D = 40 A, T_J = 175 °C		23		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 800 V, V_{GS} = 0 V, F = 100 kHz, V_{AC} = 25 mV		3340		pF
C_{oss}	Output Capacitance			125		pF
C_{rss}	Reverse Transfer Capacitance			10		pF
E_{oss}	C_{OSS} Stored Energy			51		μJ
R_g	Gate Resistance	F = 1 MHz, V_{AC} = 25 mV		1.5		Ω
Q_{gs}	Gate-Source Charge	V_{DS} = 800 V , I_D = 40 A, V_{GS} = -5/+18 V		39		nC
Q_{gd}	Gate-Drain Charge			46		nC
Q_g	Total Gate Charge			168		nC

Switching Characteristics						
Symbol	**Parameter**	**Test Conditions**	**Min**	**Typ**	**Max**	**Units**
$t_{d(on)}$	Turn On Delay Time	V_{DD} = 800 V , I_D = 40 A, V_{GS} = -4/+18 V, $R_{G,EXT}$ = 5 Ω L = 100 µH Diode： Body Diode at V_{GS} = -4V		16		ns
t_r	Rise Time			21		ns
$t_{d(off)}$	Turn Off Delay Time			47		ns
t_f	Fall Time			13		ns
E_{on}	Turn On Energy			467		µJ
E_{off}	Turn Off Energy			150		µJ
$t_{d(on)}$	Turn On Delay Time	V_{DD} = 800 V , I_D = 40 A, V_{GS} = -4/+18 V, $R_{G,EXT}$ = 5 Ω L = 100 µH Diode： Body Diode at V_{GS} = -4V T_J = 175 °C		14		ns
t_r	Rise Time			22		ns
$t_{d(off)}$	Turn Off Delay Time			56		ns
t_f	Fall Time			14		ns
E_{on}	Turn On Energy			487		µJ
E_{off}	Turn Off Energy			230		µJ
Drain-Source Diode Characteristics (T_J = 25 °C unless otherwise noted)						
I_S	Maximum Continuous Drain-Source Diode Forward Current				73.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current				183	A
V_{SD}	Diode Forward Voltage	V_{GS} = -4 V , I_{SD} = 20 A		4.6		V
		V_{GS} = -4 V , I_{SD} = 20 A, T_J = 175 °C		4.1		V
I_{rrm}	Peak Reverse Recovery Current	V_{GS} = -4 V , I_{SD} = 40 A, V_R = 800 V, di/dt = 2500 A/µs		27.5		A
t_{rr}	Reverse Recovery Time			22		ns
Q_{rr}	Reverse Recovery Charge			330		nC

Electrical Characteristics Diagrams

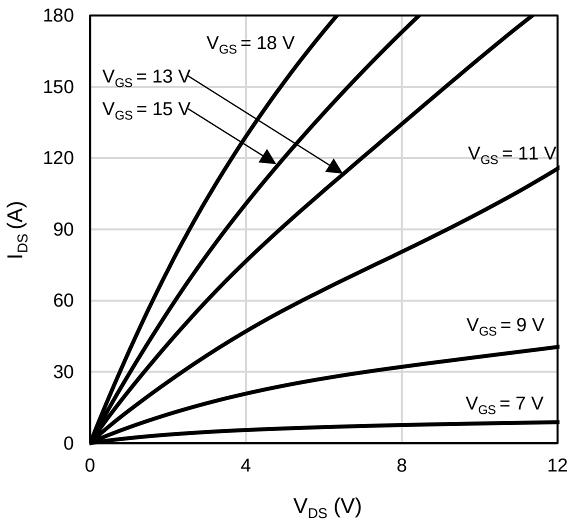


Figure 1: Output Characteristics T_J = -40°C

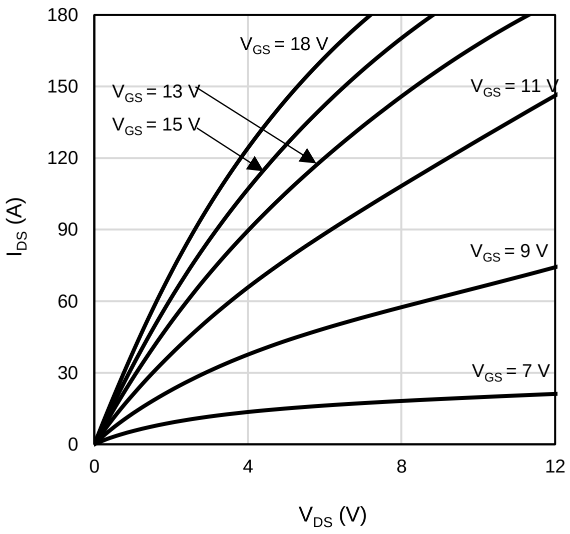


Figure 2: Output Characteristics T_J = 25°C

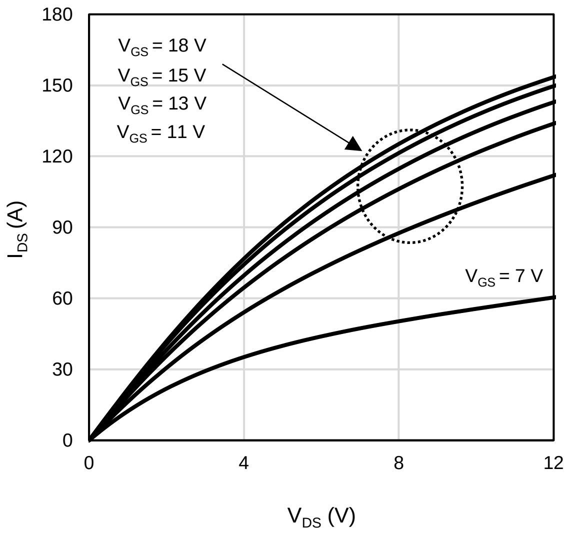


Figure 3: Output Characteristics T_J = 175°C

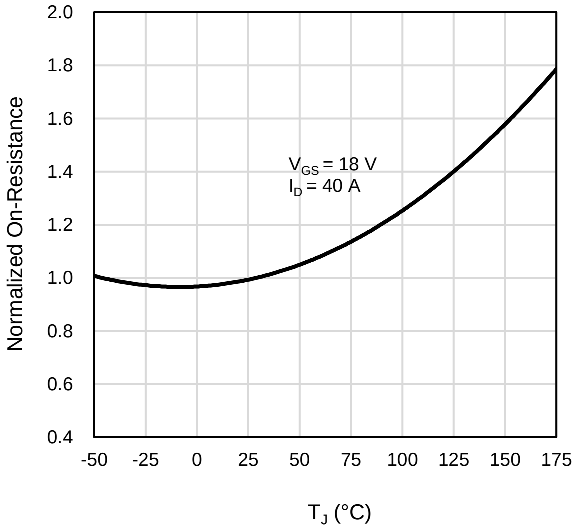


Figure 4: Normalized On-Resistance vs. Temperature

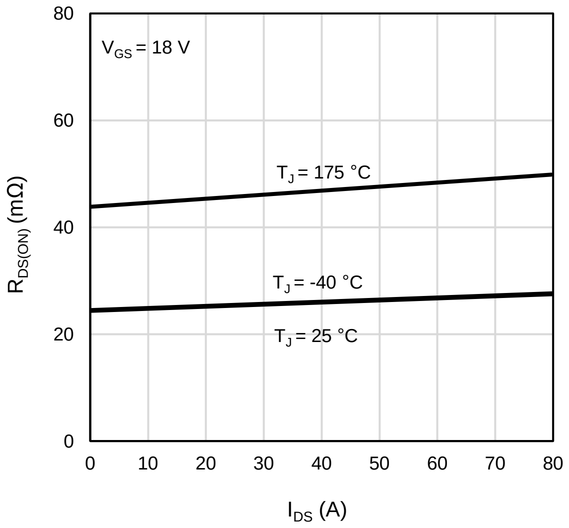


Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

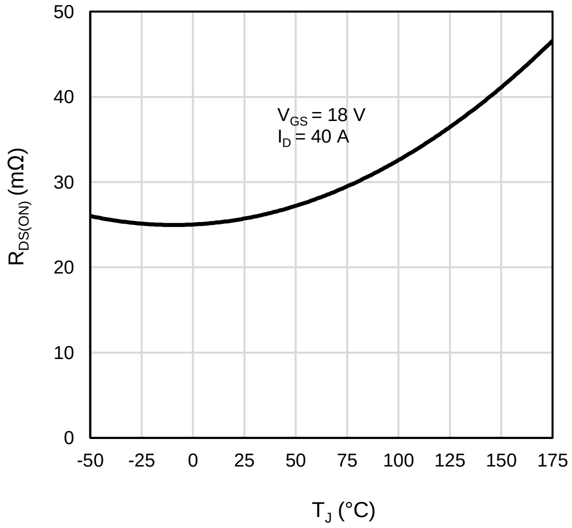


Figure 6: On-Resistance vs. Temperature

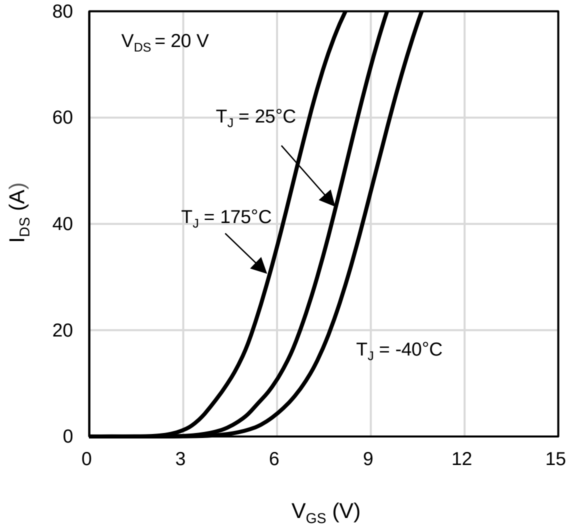


Figure 7: Transfer Characteristics For Various Junction Temparature

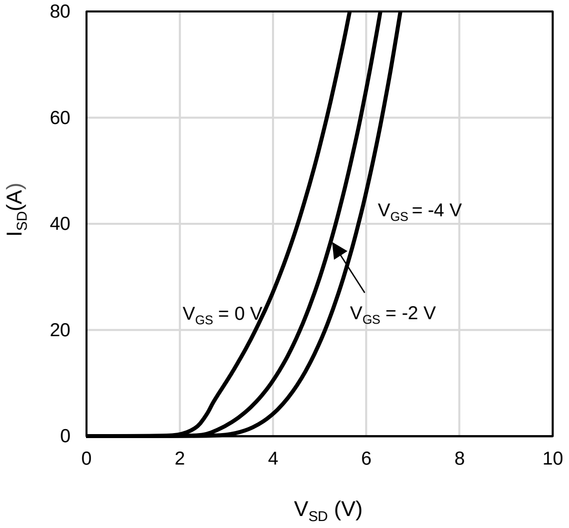


Figure 8: Body Diode Characteristics at -40°C

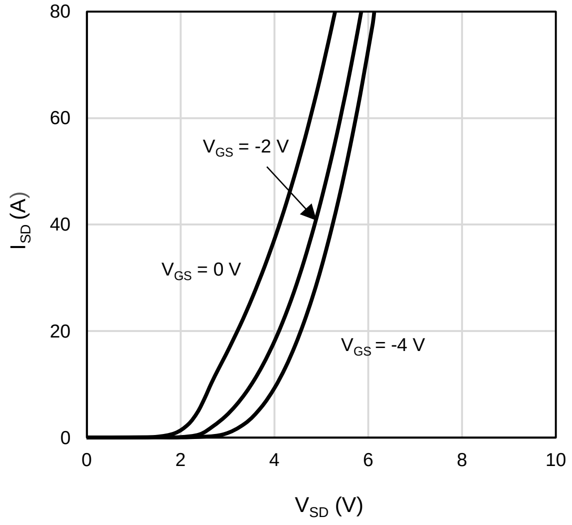


Figure 9: Body Diode Characteristics at 25°C

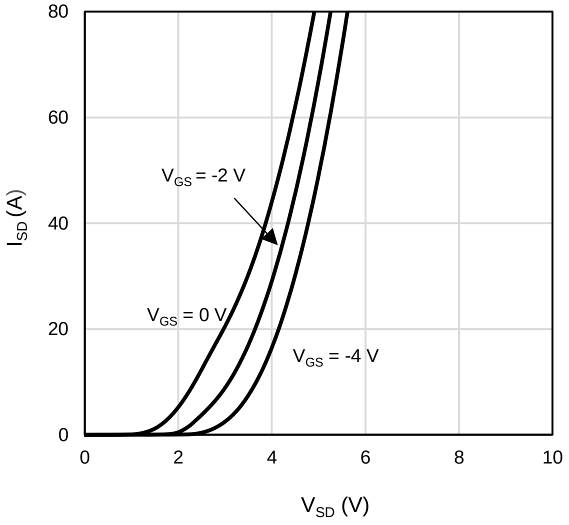


Figure 10: Body Diode Characteristics at 175°C

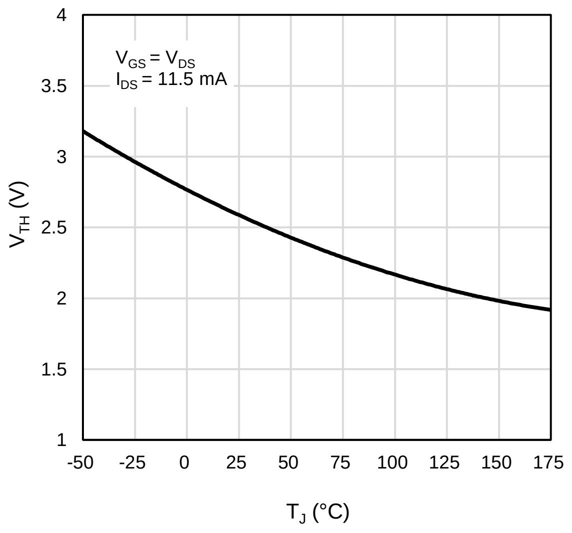


Figure 11: Threshold Voltage vs. Temperature

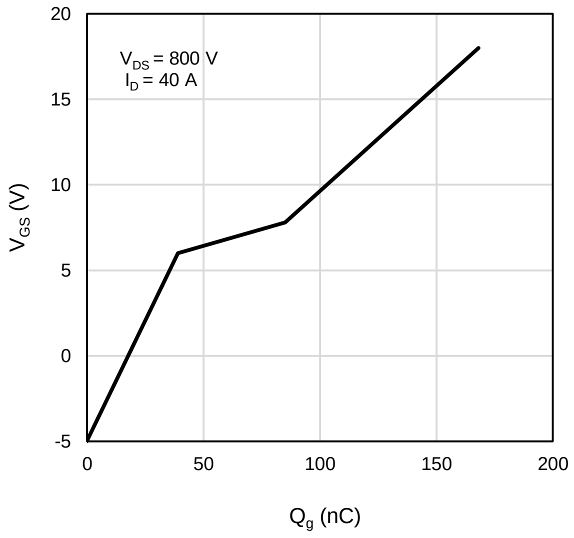


Figure 12: Gate-Charge Characteristics

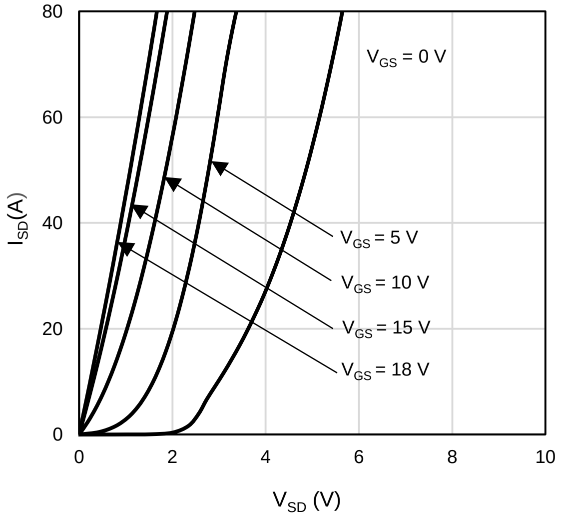


Figure 13: 3rd Quadrant Characteristics at -40°C

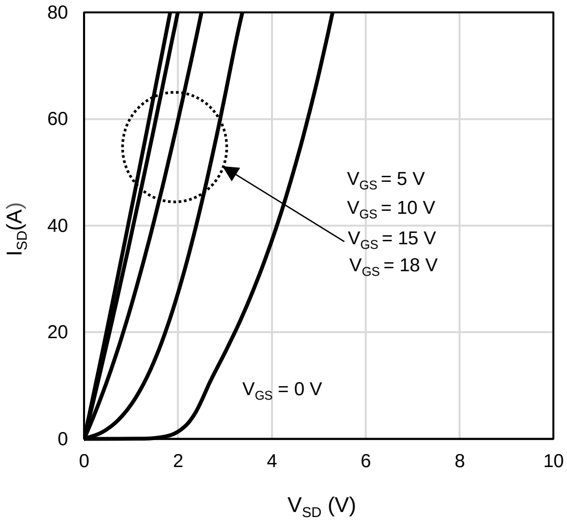


Figure 14: 3rd Quadrant Characteristics at 25°C

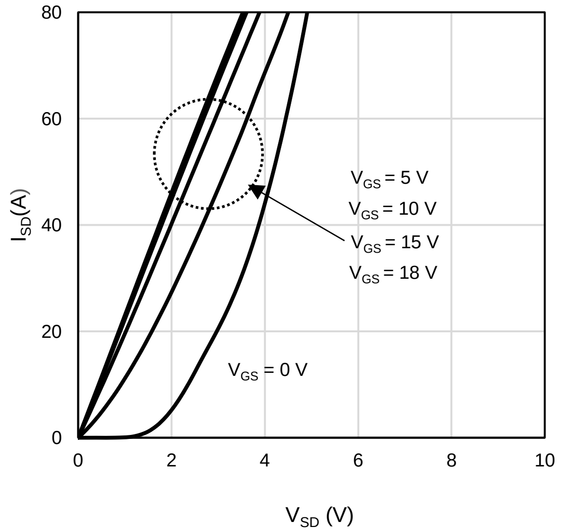


Figure 15: 3rd Quadrant Characteristics at 175°C

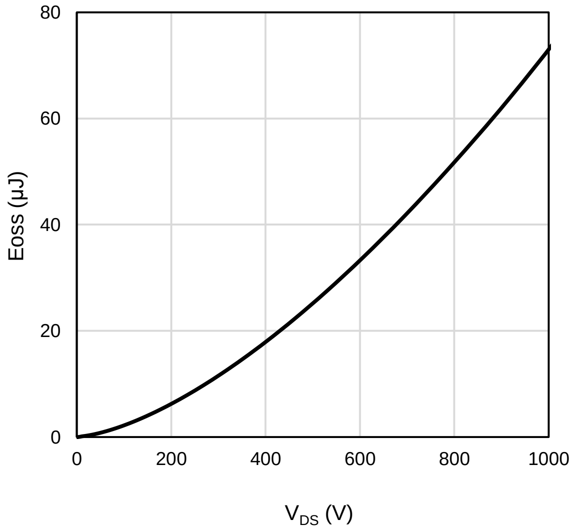


Figure 16: Output Capacitor Stord Energy

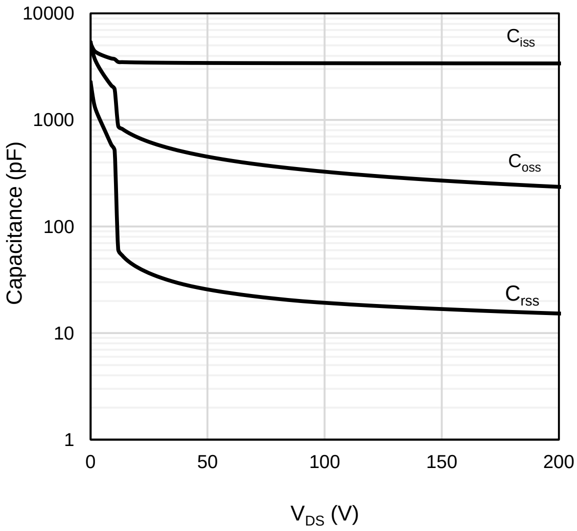


Figure 17: Capacitance Characteristics (0 - 200 V)

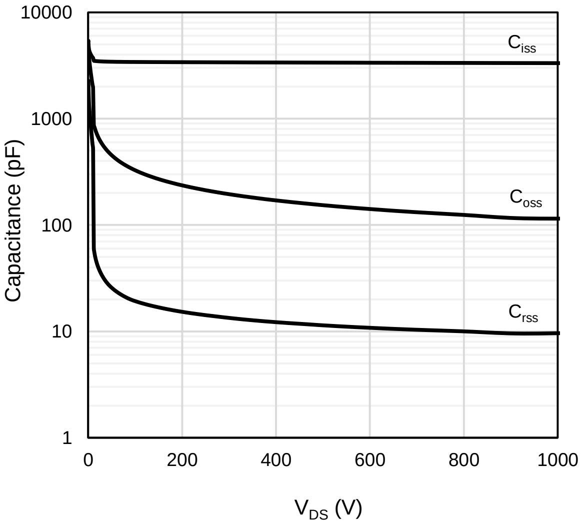


Figure 18: Capacitance Characteristics (0 - 1000 V)

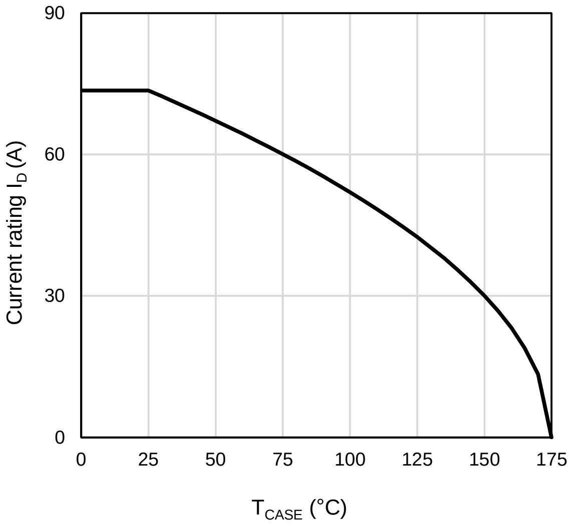


Figure 19: Current De-rating

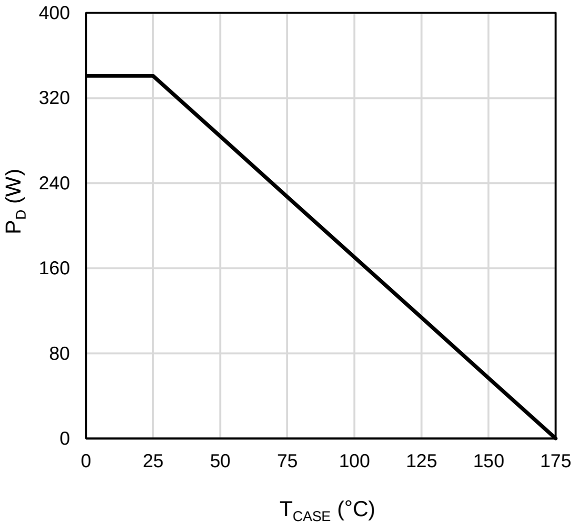


Figure 20: Maximum Power Disspation Derating vs. CaseTemperature

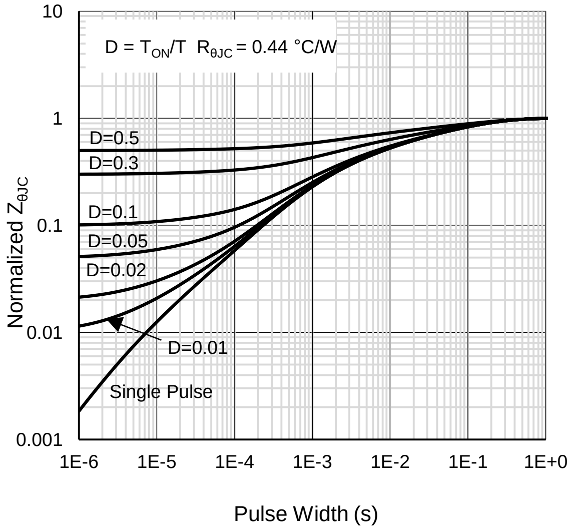


Figure 21: Normalized Maximum Transient Thermal Impedance

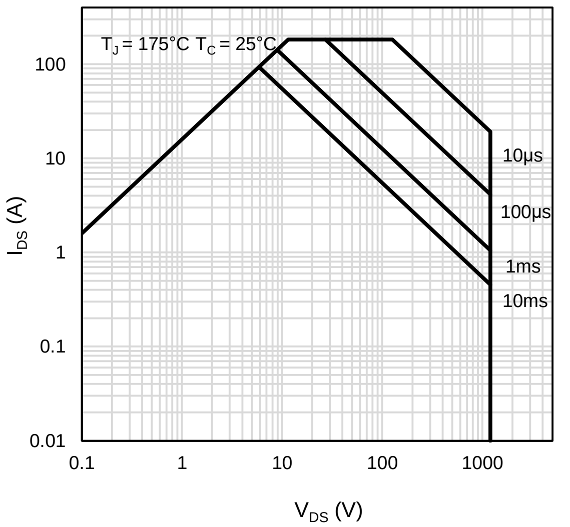


Figure 22: Maximum Forward Biased Safe Operating Area

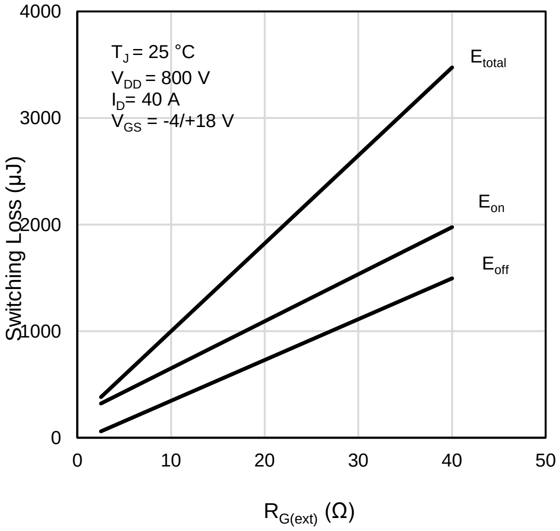


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

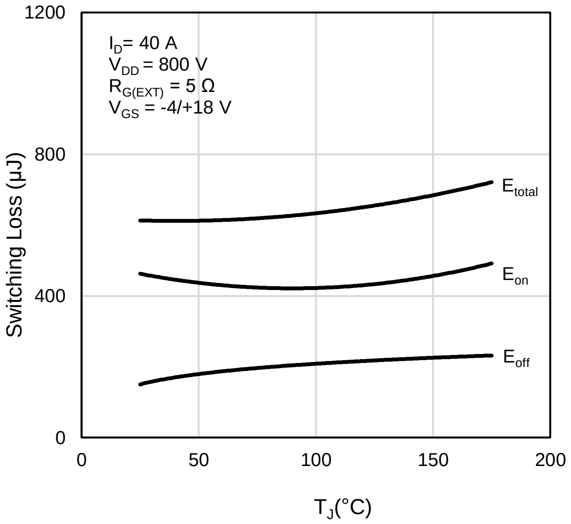


Figure 24: Clamped Inductive Switching Energy vs. T_J

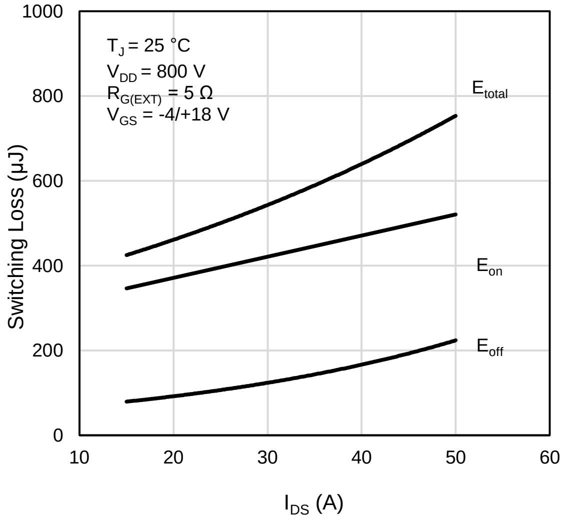


Figure 25: Clamped Inductive Switching Energy vs. Drain Current (V_{DD} =800 V)

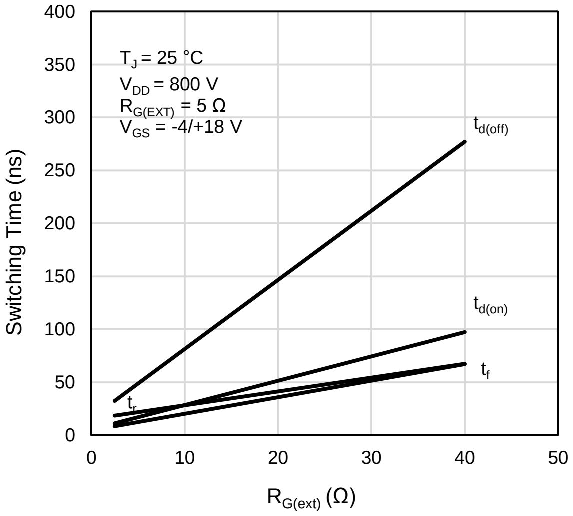
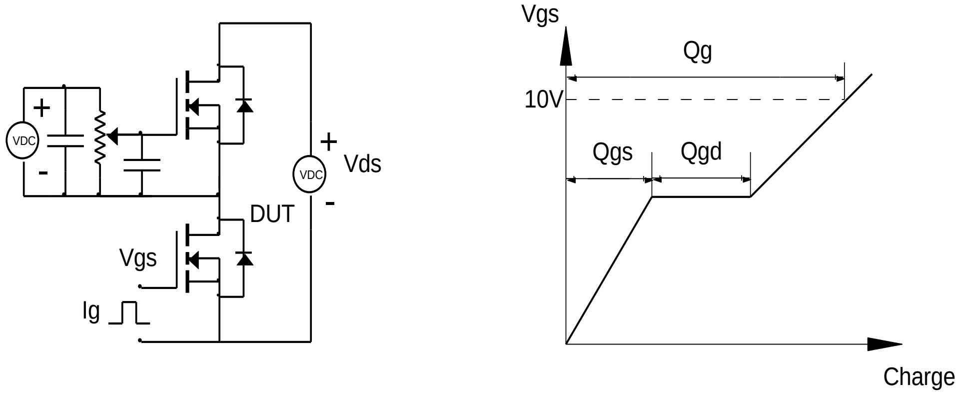


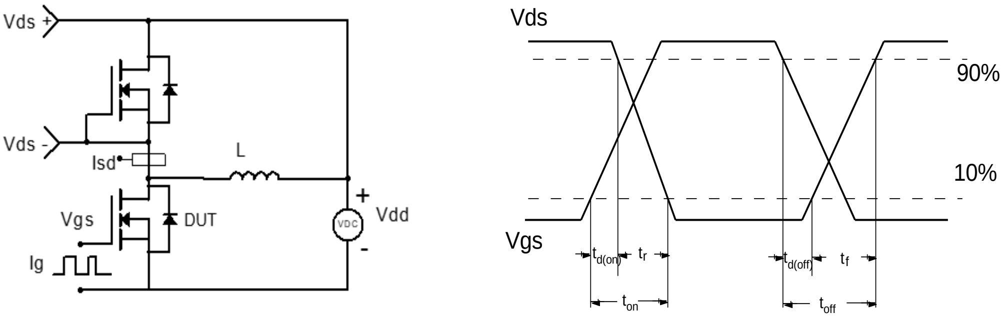
Figure 26: Switching Times vs. $R_{G(ext)}$

Test Circuit and Waveform

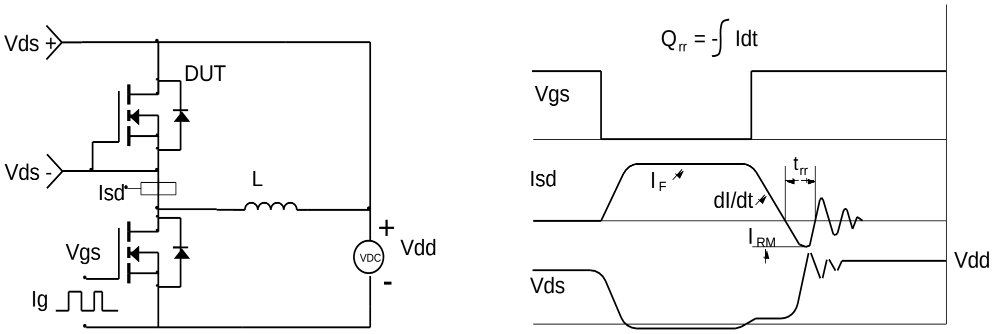
Gate Charge Test Circuit & Waveform



Clamped Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Released	Remark
Rev.1.0	2024	Initial Release

Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

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